

Research Summary

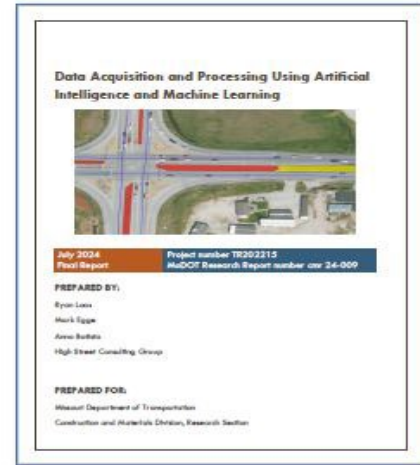
Data Acquisition and Processing Using Artificial Intelligence and Machine Learning

The convergence of trends in big data—a dramatic increase in the volume, variety, and velocity of data—and repeated breakthroughs in Artificial Intelligence (AI) and Machine Learning (ML) technologies enables decision making with unprecedented amounts of information and at a hitherto inconceivable scale. This potent combination promises to positively transform transportation planning and systems operations.

AI and ML models are good at answering only a narrow range of questions (how many, how much, when, to which group does something belong, what is shown in a photo, etc.) but, once trained, can produce millions of decisions and predictions at a very low cost.

Given the tremendous promise of AI and ML, should Missouri DOT be doing more to actively incorporate these technologies into the agency? This research provides MoDOT with an opportunity to “kick the tires” with AI and ML and better understand how these powerful technologies can help the agency meet its present and future challenges.

This report—and the research activities preceding it—endeavors to equip MoDOT with the necessary knowledge and evaluative framework to effectively assess opportunities to incorporate AI and ML technologies into the agency and make the most of these promising new technologies.



The project was executed through capacity building activities and applied evaluation methods. To build AI/ML capacity, a workshop with leaders from across the department was held to introduce AI and ML concepts and to generate ideas for their use at the department; and, a peer exchange was hosted with AI/ML leaders from other agencies to share the experiences and knowledge.

Of the 50+ work ideas for AI/ML applications at MoDOT, two were ultimately implemented to provide hands on experience and a benefit cost analysis: a median inventory derived from satellite imagery using computer vision, and a new method for Annual Average Daily Traffic (AADT) factor grouping using clustering and classification machine learning techniques.

Neither pilot project produced a favorable benefit/cost ratio, but both point in the direction of circumstances where a favorable ratio could be achieved.

Key takeaways from the research include:

1. Scale matters. 10,000 repetitions of a model output should be considered a minimum viable scale for ML to be cost effective. Millions of repetitions are better. In general, this implies that ML will rarely be a good replacement for activities currently being done by MoDOT employees, as few DOT



processes are currently being repeated tens of thousands of times.

2. Structure is important. Few decisions are made tens of thousands of times because human decision making is expensive. Unlocking the benefits of AI and ML will require fundamental rethinking and restructuring processes or even whole divisions around the possibility of dramatically lower decision costs.

As a result of this research Missouri DOT staff have gained exposure to AI and ML and provide an opportunity for hands on experience with these tools. This hands-on experience will aid in educating MoDOT staff to identify future opportunities where AI and ML can provide in meeting the unique challenges of current era with its unique new tools and technologies.

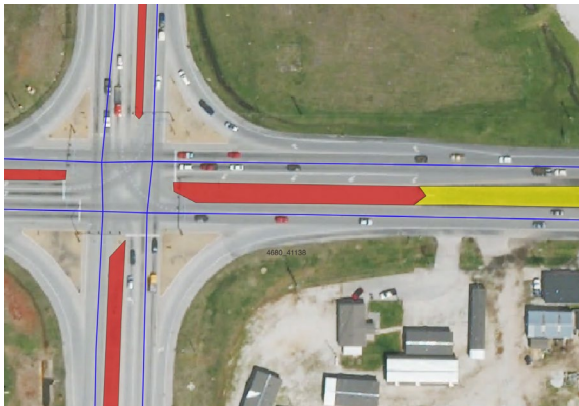


Figure 1: Sample masking of medians used to train computer vision model.

Project Information

PROJECT NAME: TR202215—Data Acquisition and Processing Using Artificial Intelligence and Machine Learning

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